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CHROMOSOME NUMBERS IN THE GENUS SESBANIA (LEGUMINOSAE): EVIDENCE FOR A CONSERVATIVE TREATMENT

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Sesbania is a genus with approximately 50 species occurring in the warmer areas of both hemispheres, particularly in wet habitats. In many parts of the world some of the species are used extensively as green manures for soil improvement. In Texas the native species have become troublesome weeds in irrigated rice fields.

The genus has been treated in various ways by taxonomists ever since its initial description in 1777. Pollard (1897), Rydberg (1923), and Jacobs (1941) have reviewed some of the pertinent literature, hence only a brief summary of its taxonomic history will be given here.

Bentham and Hooker (1865) recognized the genus as having three distinct subgenera or sections: (1) Eusesbania, (2) Daubentonia, and (3) Glottidium. Taubert (1891) treated *Sesbania* in Engler and Prantl's Pflanzenfamilien in the same fashion, recognizing these three subgenera. A similar treatment was followed by most workers until Small (1903), in treating the four species found in the United States, recognized the subgenera as distinct genera, thus re-establishing the names *Sesban* (= *Sesbania* proper—composing the subgenus Eusesbania as treated above), *Agati* (included by most workers in Eusesbania), *Daubentonia*, and the monotypic genus *Glottidium*.

Small's treatment was based primarily on fruit differences among the various taxa: *Sesbania* (including *Agati*) with linear,

many-seeded, non-winged legumes; *Daubentonia* with thickened, several-seeded, four-winged legumes; *Glottidium* with thin, two-seeded legumes, the seeds remaining in a dry, bladdery, bag-like endocarp at maturity.

Phillips and Hutchinson (1921) concluded, in a revision of the African species of *Sesbania* (23 in number), that the genus was best treated semi-conservatively, recognizing in *Sesbania* the subgenera Eusesbania (including Agati) and Daubentonia, but agreeing with Small in his treatment of *Glottidium* as a distinct genus. Again, the principal reason for recognition of the latter taxon was given as legume morphology.

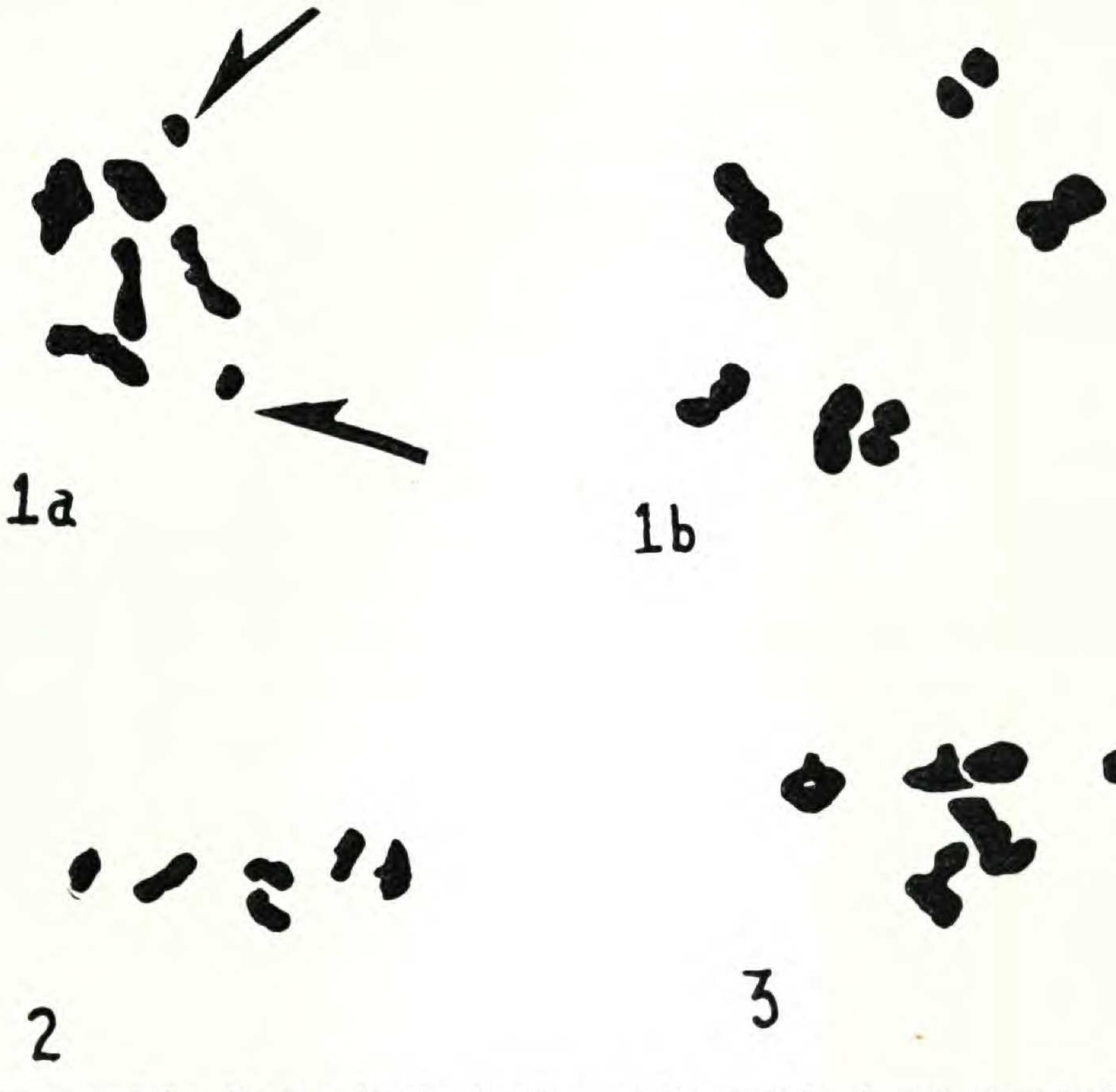
In spite of Phillips and Hutchinson's contribution, Rydberg (1924) maintained the four genera, *Sesbania* (as *Sesban*), *Agati*, *Daubentonia*, *Glottidium*, and, in addition, placed the species *Sesbania longifolia* (Cav.) DC. in a newly created, monotypic genus, *Daubentoniopsis*.

It is obvious that taxonomic workers have not exhibited any degree of unanimity in the recognition of genera or subgenera when evidence has been based on external morphology alone. As a result, Senn (1938), on the basis of three reported chromosome numbers in the genus, hinted at the possible validity for at least some of the segregated genera, stating: "*Sesbania* with n numbers 6, 7, and 16 seems to be in need of thorough study as regards the constitution of the genus . . . The occurrence of three unrelated chromosome numbers in *Sesbania* probably means that some of these species belong in different genera."

Senn counted $2n = 12$ for the single species of *Sesbania* investigated in his study. Unfortunately, as pointed out by Jacobs (1941) and more recently by Rao (1946), Haque (1946), and Sampath (1947), the chromosome numbers of $n = 16$ and $n = 7$ reported by Kawakami (1930), and Krishnaswami and Ayyangar (1935) for the other two species, on which Senn's statement was based, were found to be erroneous. When re-investigated, the correct number for both the species was found to be $2n = 24$. Jacobs added two more species counts in his study, reporting the number $2n = 12$ in both instances.

Heretofore, the following counts had been established for the genus:[1]

[1] Darlington and Janaki-Ammal (1945) list a species, *Sesbania australis*, as having $2n = 30$, and give Kreuter (1930) as the authority. This is undoubtedly an error



FIGURES 1–3. Camera lucida drawings of the meiotic chromosomes in *Sesbania* spp. 1. *S. exaltata*, 1a. Univalents indicated by arrows. 1b. Univalents paired but without chiasmata. 2. *S. drummondii*. 3. *S. vesicaria*. (× 2000).

SPECIES	2n	AUTHORITY
Eusesbania		
S. sesban (= *S. aegyptiaca*)	12	Haque; Jacobs; Rao; Sampath
S. speciosa	12	Jacobs; Sampath
S. punctata	12	Frahm-Leliveld (1953)
S. bispinosa (= *S. aculeata*)	12, 24	Haque; Jacobs; Rao; Sampath
S. exaltata (= *S. macrocarpa*)	12	Atchison (1949); Turner (Present paper)
S. marginata	12	Castronova (1945)
S. sericea	24	Frahm-Leliveld
Agati		
S. grandiflora	24	Haque; Jacobs; Rao; Sampath; Tjio (1948)
Daubentonia		
S. punicea	12	Covas and Schnack (1946)
S. tetraptera	12	Senn

since reference to the publication cited shows that there is no *Sesbania* mentioned in Kreuter's paper; the report is for *Carmichaelia australis*, which is properly listed by D. & J. on page 163.

From the above tabulation, the basic number, $x = 6$, can be inferred for the genus. The species counted include two of the usually accepted subgenera, Eusesbania and Daubentonia, as well as *S. grandiflora*, which is sometimes separated from Eusesbania and placed in the monotypic subgenus or genus, *Agati*.

In the present paper, chromosome numbers are reported for three species native to the United States, including *S. vesicaria*, the monotypic member of the subgenus Glottidium. The counts were made from P.M.C. smears. Buds were collected in 4 chloroform : 3 absolute alcohol : 1 glacial acetic acid and allowed to remain for several hours. Young anthers were subsequently removed and squashed in acetocarmine. Attempts to obtain satisfactory root-tip squashes were unsuccessful.

Below are listed the sources of materials and corresponding n chromosome numbers of the species examined.[2]

SPECIES	SOURCE	n
Eusesbania		
S. exaltata (Raf.) Cory	Texas. Travis Co.: Austin (Grown from seed collected in Austin, Texas). Aug. 17, 1954. Turner 3655.	$6(5_{II}2_{I})$
Daubentonia		
S. drummondii (Rydb.) Cory	Texas. Galveston Co.: 2 mi. N.W. of Texas City. Aug. 8, 1953. Turner 3149.	6
Glottidium		
S. vesicaria (Jacq.) Ell.	Texas. Travis Co.: Austin. (Grown from seed collected in Giddings, Texas) Aug. 17, 1953. Turner 3656.	6

Smears from a number of plants of *S. exaltata* consistently showed five bivalents and two univalents at first metaphase (Fig. 1). Similar meiotic configurations were reported for *S. sesban* and *S. bispinosa* by Jacobs. All three of these species belong to the subgenus Eusesbania. *S. drummondii* and *S. vesicaria* both showed 6 bivalents at metaphase. Chromosome morphology appeared similar in the three species examined.

Discussion

Rollins (1953) has briefly discussed the value and limitations of chromosome numbers in the circumscription of plant taxa.

[2] Voucher specimens have been deposited in The University of Texas Herbarium, Austin, Texas.

He points out that chromosome numbers are valuable evidence for taxonomic purposes in some cases and of little or no importance in others. The genera in the Leguminosae are notable for their constancy. It was only natural that Senn raised the question of possible generic validity for those taxa thought to have different numbers. Re-examination of these species and counts of additional members of all proposed generic segregates, except the recently proposed *Daubentoniopsis*, shows the base number to be $x = 6$.

The constancy of chromosome numbers in *Sesbania* does not necessarily mean the segregate taxa are not "good" genera; on the other hand it does indicate that there is no cytologic evidence to justify their segregation. The author agrees with Rollins when he states, ". . . chromosomes provide essentially the same kind of evidence to be derived from other parts of the plant." *Sesbania*, then, has another character that links the subgenera together in a single taxon, giving support to such legume workers as Bentham and Taubert who considered external morphological features alone in their world-wide treatments of this genus. It appears that where generic segregation has been proposed for these taxa by recent American workers there has been a tendency to place excessive weight on the characters of the mature pod. From the standpoint of total morphology in the various subgenera, the sum of their resemblances far exceeds their differences.

It is hoped that future genetical work and comparative studies (embryological and anatomical) will be forthcoming so that a more complete synthesis of information will be available from which to draw taxonomic conclusions. Until such additional work is completed it seems best to treat the proposed segregates as subgeneric taxa in *Sesbania*.

Summary

Chromosome counts of $n = 6$ for three species of *Sesbania* are reported: *S. exaltata*, *S. drummondii*, *S. vesicaria*. These species belong to the respective subgenera Eusesbania, Daubentonia, and Glottidium. Previous chromosome reports for the genus have been reviewed. From established counts, a base number of $x = 6$ may be inferred for the genus. Until more evidence is forthcoming, it has been concluded that the genus *Sesbania*

is best treated as containing the subgenera, Daubentonia and Glottidium, as well as the other generic segregates that have been proposed by various authors.—THE PLANT RESEARCH INSTITUTE, THE UNIVERSITY OF TEXAS, AUSTIN, TEXAS, AND THE CLAYTON FOUNDATION FOR RESEARCH.

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